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ABSTRACT

Noting a low rate of utilization of computers by content area teachers in their classrooms, this paper argues that classroom teachers are generally unaware of how computers can enhance teaching and learning and of how computers can be integrated into the curriculum. In response, an introduction to both productivity and instructional software is provided, and specific examples of instructional software (drill and practice, tutorial, simulation, educational games, and problem solving software) are described. A nine-step model is also provided to assist teachers who wish to integrate computers into their teaching. Finally, the paper describes five basic computer configurations that can be used in the classroom, noting that the teacher's role changes with each configuration. It is concluded that the training of teachers for technology use must begin now so that they are prepared to integrate computers and other information technologies into their teaching in order to meet the needs of the changing society. (GL)

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INTEGRATING TECHNOLOGY INTO THE CURRICULUM

A presentation for the TCEA conference in March 1989, prepared and delivered by Fayette Clarke, Ed.D., and Ellen Murphy, M.A.

Most people will agree that computers are in the schools, but the question remains as to how well the computers are being used by content area teachers. Research by Swadener and Jarrett (1988) shows that the predominant use of computers in middle and high schools is in computer classes. Few teachers in noncomputer classes are using computers to aid their instruction. In secondary schools, business education and language arts teachers are using computers to teach word processing. These researchers found that certain areas must be addressed before there is an increase in computer use in noncomputer classes. These areas are staff development, availability of equipment, software, and materials.

A series of charts by Robert Rothman (1988) allows us to draw certain conclusions about the use of computers in schools. For example, computers are being used mainly for writing letters, stories, and reports. Approximately 49.8 percent of seventh graders use the computer for writing. In eleventh grade, 46.5 percent of students use the computers for writing. However, fewer students use the computers for making graphs and databases. In seventh grade 73 percent never use a computer to make a graph, and 84.6 percent never use the computer to make a database. The figures are about the same for eleventh graders.

A survey of computer use in the subject areas revealed that computer use was greatest in math and that usage decline from third grade to eleventh grade. For example, in reading and English 25 percent of third graders had used computers; 23.9 percent in seventh grade; and 16.9 percent in eleventh grade. This information suggests that computers are not being widely used in the classroom. The further implication is that classroom teachers are unaware of how computers

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can enhance teaching and learning and how they can be integrated into the curriculum.

Teachers need to know what software is are available. Software is broadly divided into two groups–**productivity and instructional.** Productivity software can be used by teachers and students to make them more productive in less time. Information can be organized so that it is readily accessible and easily updated. Productivity software includes word processors, databases, and spreadsheets. Instructional software refers to computer-assisted instruction in the subject areas. This software supports specific objectives and is designed to support the instruction provides by teachers. Instructional software can be further divided into five types which utilize commonly used teaching strategies. (Insert diagram here with all five.)

Drill and Practice software is the most common type of instructional software. Drill and practice programs tailor instruction to the individual, provide a random selection of items, and give immediate feedback and reinforcement. The teacher selects the material by matching the instruction to the student, the computer presents the material and records student progress, while the student interacts with the computer and sees the result. This is very much like the drill teachers provide after a concept or fact is taught. The advantage of the computer is that it will individualize information for each student and will provide a variety of practice items. The feedback and possible explanation of the problem helps the student to see where the mistake was made and to see the correct solution.

Tutorial software presents new concepts and tailors instruction for the individual. Immediate feedback is also a feature of the computerized tutorial. Again the teacher selects instruction and adapts it to student needs,the computer presents the information and monitors responses, and the student interacts with the computer and sees the results. Tutorial software can be used for students who have been absent, or for students who do not understand a concept and need to review the entire lesson or part of a lesson.

Simulation software is used to approximate real events, to compress years into minutes, and to test hypotheses. This type of software is very useful in science classes where students have to work with dangerous chemicals or expensive equipment. The computer simulates the situation and precludes the necessity for the real equipment. Students can also project results by using the "what if" function. In this mode the teacher introduces the subject, gives background information, and guides the discussion. The computer plays the role designated and delivers the results of the decisions. The student is able to evaluate decisions, make choices, and discuss results.

Educational games software uses the gaming format to present materials that students need to master. Games motivate students and develop logical guessing. Basic facts are also presented in a new way. Educational games can foster both cooperation and competition among students. With this software, the teacher sets the limits, directs the process, and monitors the results. The computer acts as the competitor, judge, and scorekeeper. The student learns the strategy presented, evaluates choices, and competes with the computer.

Problem solving software can be used to help students develop higher-level thinking skills. This type of software works with data to systematize instruction, and to perform rapid calculations. The teacher assigns the problem and checks the results, while the computer processes the data and provides the answers. The student defines the problem and sets up the solution. These five types of software uses strategies familiar to teachers, but the instruction is delivered via the computer.

How does a teacher prepare to integrate computers into the curiculum? McCarthy (1988) identifies steps that will help in preparing for integration.The following nine steps are adapted from his list.

1. Choose the subject or course that will reinforce or extend with the computer.
2. Decide on an integration level (course, unit, or lesson) and a

developmental approach.

3. Divide the curriculum into manageable portions and set a schedule for the development of each portion.
4. Identify the goals and objectives for the first portion.
5. Decide on the learning activities for each objective.
6. Decide which learning activities would best be supported by a computer application.
7. Seek or adapt software that will provide the application in the desired subject areas.
8. Arrange for access to hardware.
9. Repeat steps four through eight for each portion of the curriculum following a schedule.

The first five items on this list are basic procedures for preparing to teach, and all well-prepared teachers go through these steps in the normal course of preparation. Selecting the computer activities and the software are new steps in the preparation process. Any teacher who is going to integrate computers into his/her teaching must have had adequate training. This training should include knowledge of the computer, software selection criteria, and guidance on how to use the computer in the classroom.

There are five basic computer configurations that can be used in the classroom, and the teacher's role changes with each one. The normal pattern in many schools is one of no technology. In this situation the teacher has many roles but is mainly the presenter of information.

The first computer configuration uses one computer in the classroom to enhance the presentation of information. When the teacher is using the one-computer configuration for group demonstration, the following steps are necessary:

- plan in advance
- feel at ease with the equipment
- lead the discusion to integrate student comments into the points being made
- summarize and draw conclusions

The second configuration uses one computer as a class resource or to reinforce concepts being taught. In this mode, the teacher directs students to do the activity at suitable times and monitors progress. The third configuration uses the computer with small groups. The teacher prepares students for the activity,

answers questions, and quizzes students after the activity. When the computer is used with small groups, the teacher has the following responsibilities:

- plan the lessons in advance
- introduce the lesson so as to minimize later student questions about how to proceed
- be able to quickly solve equipment and software problems that arise for students
- sense the collective pace of the group
- answer questions in a way that does not do the work for students
- summarize and draw conclusions

The fourth configuration uses the computer to present information to the student. The student uses the computer to gather information or to solve a problem. In this mode, the teacher serves as a resource.

As technology continues to impact the workplace, the effect will be felt in the schools as the design and delivery of the curriculum will have to be different. Teachers who have learned to integrate technology into their curriculum will be the leaders of curriculum changes for the future. The training of teachers skilled in technology must begin now so that they are prepared to integrate computers and other information technologies into their teaching in order to meet the challenges of the changing society.

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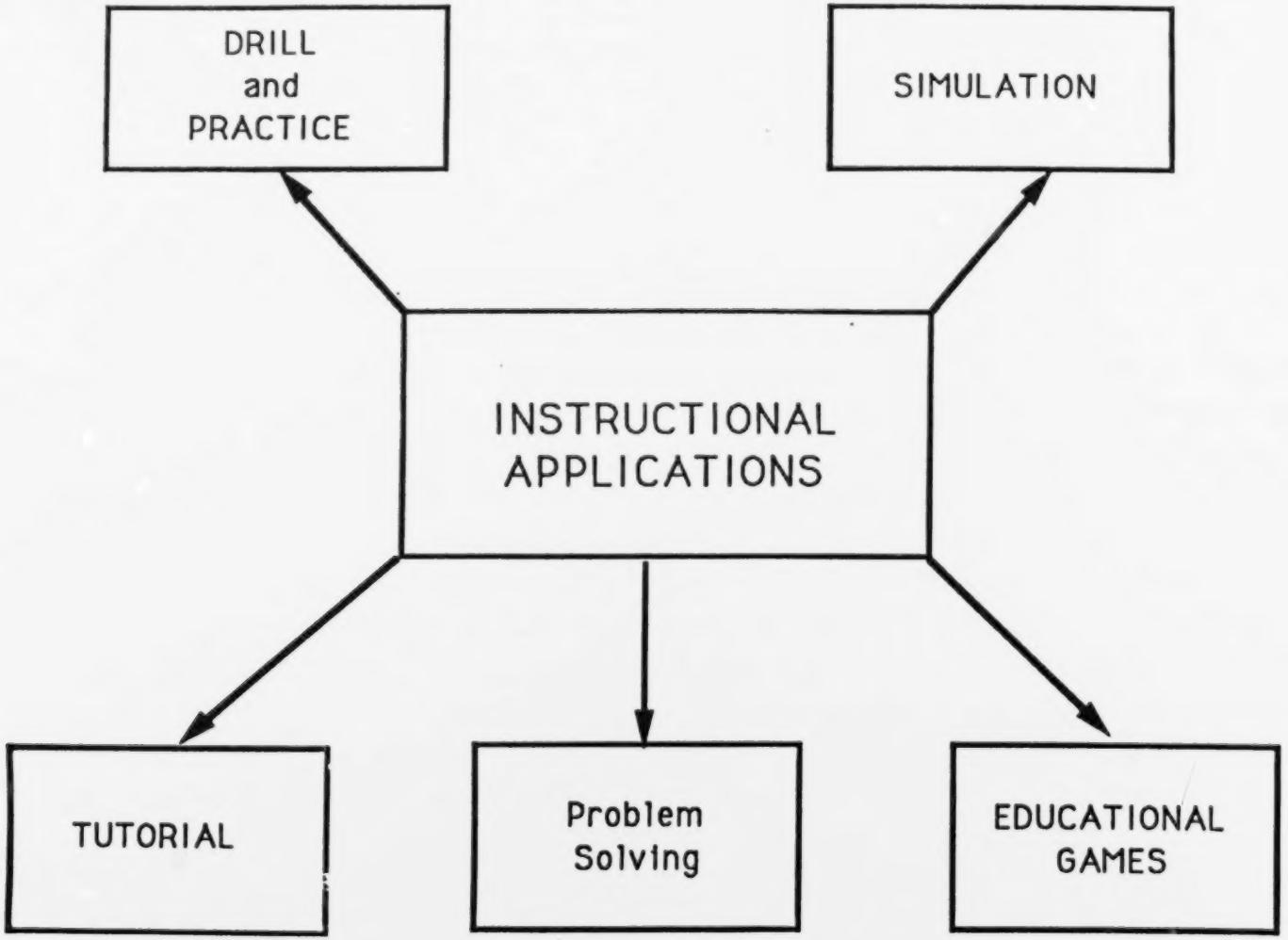
Diagram to be inserted on page 2



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